

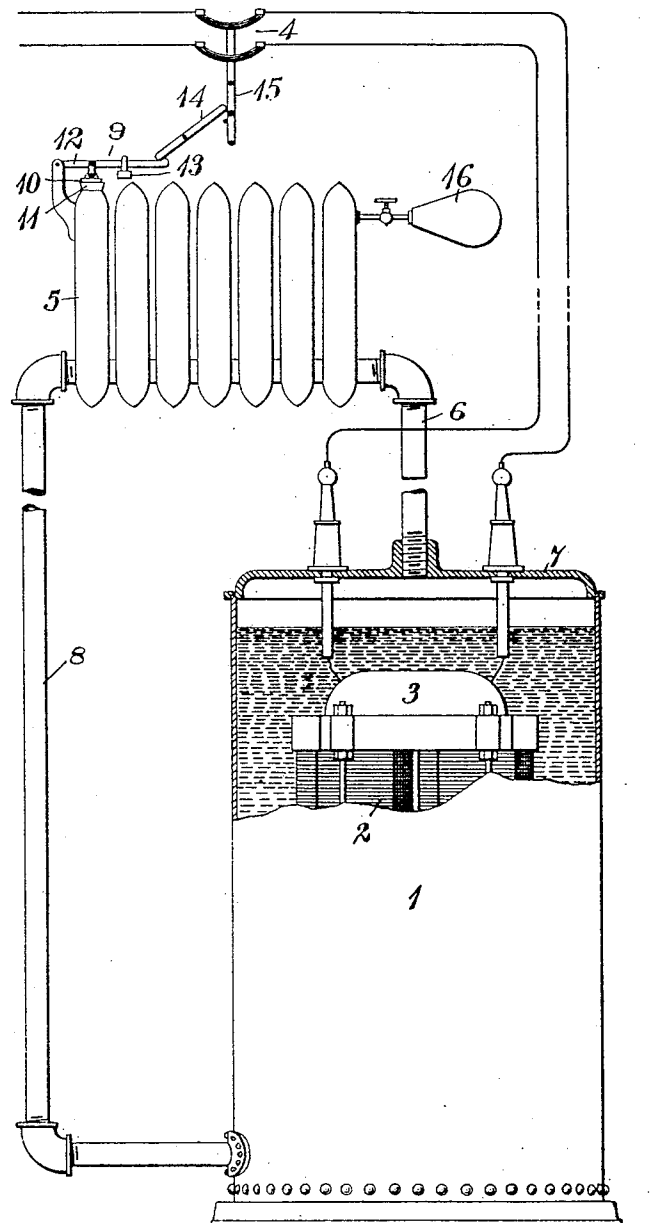
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No. 854,276.

PATENTED MAY 21, 1907.

F. DARLINGTON.
TEMPERATURE REGULATOR.
APPLICATION FILED SEPT. 5, 1905.



WITNESSES:

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TEMPERATURE-REGULATOR.

No. 854,276.

Specification of Letters Patent.

Patented May 21, 1907.

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To all whom it may concern:

Be it known that I, FREDERICK DARLINGTON, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Temperature-Regulators, of which the following is a specification.

My invention relates to methods of conveying heat away from or cooling electrical and other heat producing devices and its object is to provide a novel and efficient method for the purpose indicated.

In the operation of all electrical translating devices the parts become heated on account of the energy losses in the electric and magnetic circuits and it has long been the practice to surround such devices, particularly stationary transformers, with a medium in which convection currents may be set up by the heat, dissipation of the heat and consequent cooling of the parts being thereby caused to occur more rapidly than would otherwise be the case. It has been customary to employ oil as the medium in which to locate such devices because of its insulating properties. Oil, however, is dense and inert and the convection currents produced in it are so slow as to produce a very slow dissipation of the heat. As the mechanical dimensions of many electric devices, such as transformers, depend principally or entirely upon the ability of the parts to dissipate heat, it is evidently desirable that a more rapid method of cooling the parts be provided than by the production of convection currents in the surrounding medium.

My invention consists broadly in placing the device to be cooled in an insulating medium which is preferably non-combustible and also a non-supporter of combustion and which is volatile at a temperature above which it may be impracticable or undesirable to operate the device.

The single figure of the accompanying drawing illustrates diagrammatically a suitable means for practicing my invention.

Located within a suitable receptacle 1 is a transformer 2, in the circuit with one of the windings 3 of which is a circuit-breaker 4. The receptacle 1 is included in a system of circulation that comprises further a con-

denser 5, a piping connection 6 between the same and a cover 7 for the receptacle and another pipe 8 that connects the condenser and the bottom of the receptacle.

A safety valve 9 is provided in the circulating system at the upper part of the condenser 5 for the purpose of automatically relieving the pressure of the gas which may be present in the system when the temperature exceeds a predetermined amount. The safety valve comprises a plug 10 that fits into a seat 11, a lever 12 that is operatively connected in any suitable manner to the plug 10, and a weight 13 that maintains a pressure of the plug 10 upon its seat 11. One end of the lever 12 is adapted to engage one end of another lever 14 which when the lever 12 is raised, causes breaking of the joint of toggle members 15 that maintain the circuit-breaker 4 in closed position. By these means the circuit of the transformer winding is interrupted whenever the pressure of the circulating system exceeds a predetermined amount. Means may also be provided for maintaining an approximately constant pressure in the circulating system and such means may comprise a gas bag 16 or any other suitable gasometer device.

The receptacle 1 is filled to the level indicated with an insulating medium which volatilizes or vaporizes at a temperature less than that at which it becomes dangerous or undesirable to operate the transformer. Preferably the medium is also non-combustible and a non-supporter of combustion in its vaporous state. Any suitable substance which possesses one or more of the above-specified properties may be employed but that which I prefer to use is carbon tetra chlorid, which, at ordinary temperatures, is a colorless liquid and which boils at $76\frac{1}{2}^{\circ}$ centigrade. This substance is also a very good insulating material, tests having shown that it possesses approximately the same insulating properties as the best oil which has heretofore been employed. The said material is also non-combustible; its vapor is a non-supporter of combustion; it is not readily broken up or decomposed and has no marked chemical affinity for water, air or other common gases and substances and, because of its stability and the other properties which have been indicated, it constitutes a very desirable medium

with which to surround electrical devices. Since the material boils at a degree of temperature which it is generally not desirable to exceed in the operation of electrical devices, it is peculiarly well adapted for the purpose specified. While convection currents may also occur in the fluid specified, the cooling is caused primarily by the change from a liquid to a vaporous condition of the substance at the locally heated parts of the transformer and the vapor being of less density than the liquid, rises and conveys heat with it. The vapor of the medium rises into the condenser and is condensed, and is then returned to the transformer by way of the pipe 8. Thus the latent heat of evaporation of the liquid is utilized to effect cooling of the transformer. If the vapor were not confined, its volume would increase as the transformer became warmer but owing to its confinement the pressure increases. If it is desired to maintain the pressure permanently constant a gasometer of any suitable description, such as that shown at 16, may be employed. It may also be desirable to prevent the pressure of the gas from exceeding a predetermined limit and for that reason the safety valve 9 is provided.

In practical operation, the weight 13 may be adjusted so that the pressure of the gas which will raise the safety valve, may be any desired per cent. higher than the pressure required for normal operation so that upon excessive heating, which may be caused by short circuits, the safety valve will open. Additional protecting means may also be provided, such as the connection indicated between the safety valve and the circuit-breaker whereby the circuits of the transformer windings may be interrupted when the safety valve is raised. In beginning operation of the transformer it will generally be found most expedient to allow the vapor to escape until the medium and the transformer parts have attained an approximately constant temperature, in order that an increasing or abnormal pressure may not be exerted upon increase of temperature with a consequent raising of the temperature at which the medium vaporizes.

While I have shown and described a specific means for practicing my invention, I desire it to be understood that any other suitable means may be employed, that is, I do not limit myself to the specific medium indicated but simply to a medium having substantially the same properties, nor to the specific means for condensing the vapors; for providing against excessive pressures; for maintaining the pressure constant or to other details of construction and arrangement which evidently may be modified greatly, within limits, without departing from the spirit of the invention. It should also be understood that the method may be

applied to the cooling of any heat-producing or heat-radiating devices whether the heat is produced electrically or otherwise. The heat-producing device here selected being only one of many which it may be desirable to cool.

I claim as my invention:

1. A temperature regulator for a heat-producing device, comprising an insulating medium in which the device is immersed that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such device.

2. A temperature regulator for a heat-producing device, comprising an insulating fluid in which such device is immersed, said fluid being volatilizable at a temperature not greater than the maximum at which it is desired to maintain such device.

3. A temperature regulator for heat-producing devices, comprising an insulating, non-combustible medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices.

4. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices, and means for condensing the vaporized medium to its original state.

5. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain such devices, and means for condensing the vaporized medium to its original state.

6. A temperature regulator for heat-producing devices, comprising an insulating, non-combustible medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices, and means for condensing the vaporized medium to its original state.

7. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices, means for condensing the vaporized medium to its original state, and means for maintaining an approximately constant pressure upon the medium.

8. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain such devices, means for condensing the vaporized medium to its original state, and means for maintaining an approximately constant pressure upon the medium.

9. A temperature regulator for heat-producing devices, comprising an insulating, non-combustible medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices, means for condensing the vaporized medium to its original state, and means for maintaining an approximately constant pressure upon the medium.

10. A temperature regulator for a heat-producing device, comprising a receptacle, and an insulating fluid in which the device is immersed that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain the device.

11. A temperature regulator for a heat-producing device, comprising a receptacle, and a medium for immersing the device that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain the device and means for condensing the vaporized medium to its original state.

12. A temperature regulator for a heat-producing device, comprising a receptacle, and a medium for immersing the device that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain the device, means for condensing the vaporized medium to its original state, and means for returning the condensed medium to the receptacle.

13. A temperature regulator for a heat-producing device, comprising a surrounding medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the device, circulation of the medium in proximity to the heated portions of the device being caused by ebullition thereof.

14. A temperature regulator for a heat-producing device, comprising a surrounding medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the device, circulation of the medium in proximity to the heated portions of the device being caused by ebullition thereof, and means for condensing the vaporized medium to its original state.

15. A temperature regulator for a heat-producing device, comprising a receptacle for the device, a medium contained therein for surrounding the same that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the device, and a condenser, circulation of the medium in proximity to the heated portions of the device being effected by ebullition of the medium, and the rising of the vapors thus formed into the condenser.

16. A cooling medium for heat-producing devices, comprising carbon tetra chlorid.

17. A cooling means for heat-producing

devices, comprising a surrounding medium of carbon tetra chlorid and a condenser for the vapors thereof.

18. A cooling means for heat-producing devices, comprising a surrounding medium of carbon tetra chlorid, a condenser for the vapors thereof, and means for maintaining an approximately constant pressure upon the medium.

19. An automatic cooling means for heat-producing devices, comprising a surrounding insulating and non-combustible medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the devices.

20. An automatic cooling means for heat-producing devices, comprising a surrounding insulating and non-combustible medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the devices and a condenser for the vapors thereof.

21. An automatic cooling means for heat-producing devices, comprising a surrounding insulating and non-combustible medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the devices, a condenser for the vapors thereof, and means for maintaining the pressure upon the medium approximately constant.

22. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature of approximately the same degree as the maximum at which it is desired to maintain such devices, and the vapor of which is a non-supporter of combustion.

23. A temperature regulator for heat-producing devices, comprising a surrounding medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain such devices, and the vapor of which is a non-supporter of combustion.

24. A temperature regulator for heat-producing devices, comprising an insulating, non-combustible medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain such devices, and the vapor of which is a non-supporter of combustion.

25. The method of regulating the temperature of a heat-producing device, which consists in causing a circulation of a surrounding insulating and non-combustible medium that volatilizes at a temperature not greater than the maximum at which it is desired to maintain the device.

In testimony whereof, I have hereunto subscribed my name this 9th day of August 1905.

FREDERICK DARLINGTON.

Witnesses:

NELLIE SKINNER,
BIRNEY HINES.